

REMARKS

In order to expedite the prosecution of the present application, the subjects matter of Claims 2 and 5 have been combined with the subject matter of originally presented Claim 11 and represented as newly added Claim 16. Newly presented Claim 16 also complies with the requirements of 35 USC 112 in that it specifies that the numerical value of the weight-average molecular weight of the copolymer and the emulsion used as the precipitation inhibitor is more than ten times greater than that of the copolymer of the original binder. This is what Applicants meant by the description of "greater by more than one digit" in the specification. Support for this amendment can be found on pages 19 and 20 of the present specification where the weight-average molecular weight of the copolymer in the organic binder was 88,900 and the weight-average molecular weight of the copolymer in the emulsion used as the precipitation inhibitor was 2,960,000. No new matter has been added. Additionally, Claims 2, 5 and 12-15 have been canceled.

Claims 2, 3, 5 and 11-15 have been rejected under 35 USC 103(a) as being unpatentable over Hasegawa et al in view of Morley et al, Conn et al and Harakawa et al. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

The presently claimed invention is directed to an aqueous aluminum brazing composition comprising a K-Zn-F-type zinc fluoride flux, an organic binder comprising a (meth)acrylate copolymer containing at least one carboxyl group-containing monomer, a (meth)acrylic acid/(meth)acrylate copolymer emulsion added as a precipitation inhibitor in an amount of 0.03-1.50 wt.%, based on 100 wt.% of the brazing composition, and an amino alcohol having a boiling point of 120-200°C as a reaction inhibitor for inhibiting a reaction between zinc contained in the flux and a carboxyl group contained in the organic binder or the precipitation inhibitor. The numerical

value of the weight-average molecular weight of the copolymer and the emulsion used as the precipitation inhibitor is more than ten times greater than that of the copolymer of the organic binder and the brazing composition has a thixotropic index of 1.01-1.20.

As explained previously, the instant invention is directed to an aqueous aluminum brazing composition which overcomes problems associated with conventional aluminum brazing compositions containing an organic binder including a carboxyl group and a zinc-based flux. In these conventional compositions, there is a problem of the viscosity of the aqueous aluminum brazing composition increasing due to a chemical reaction between the carboxyl group and the organic binder and the zinc powder in the flux and the specific gravity of the zinc-based flux in the brazing composition being so large that it precipitates within several hours after preparation of the brazing composition, which makes the uniform application of the brazing composition difficult. The present invention provides a (meth)acrylic acid/(meth)acrylate copolymer emulsion as a precipitation inhibitor in an amount of from 0.03 to 1.5 wt.%, based on 100 weight percent of the brazing composition, with the weight average molecular weight of the copolymer which makes up the precipitation inhibitor being at least ten times greater than that of the organic binder so that a suitable thixotropic viscosity is given to the brazing composition. The present invention also requires that a reaction inhibitor be present which inhibits the reaction between the zinc and a carboxyl group in the organic binder or the precipitation inhibitor. These requirements overcome the problems of conventional aqueous aluminum brazing compositions containing a zinc-based flux. It is respectfully submitted that the presently claimed invention clearly is patentably distinguishable over the prior art cited by the Examiner.

The Hasegawa et al reference discloses a water-based binder which is used in the manufacture of aluminum brazed

products. The binder is obtained by saponifying an ester methacrylate polymer that has an acid value and a glass transition temperature within specified ranges. This binder can be used with an alcohol which is water soluble and volatile and has a flashpoint higher than a specified temperature and the brazing composition in which the binder and flux and the like are combined do not have the risk of catching on fire or exploding, has an excellent wetability and can be uniformly coated on an aluminum material. Since this reference is directed to a water-based binder for a non-corrosive and non-reactive flux, such as potassium fluoroaluminate, there is not a problem of this type of flux reacting with the carboxyl group in the organic binder and the increasing of the viscosity of the brazing composition due to a chemical reaction between the carboxyl group and the organic binder in the flux. There also is no problem with respect to the precipitation of the flux because the specific gravity of the flux is not large. The Hasegawa et al reference has no disclosure with respect to using a zinc-based flux, the problems associated therewith and the (meth)acrylic acid/(meth)acrylate copolymer emulsion. Therefore, the secondary references cited by the Examiner must provide the motivation to one of ordinary skill in the art to modify Hasegawa et al in a manner that would yield the presently claimed invention. It is respectfully submitted that the secondary references contain no such disclosures.

The Morley et al reference discloses a brazing flux composition comprising brazing flux and a synthetic resin based, as its main constituent, on a methacrylate homopolymer or a methacrylic copolymer, wherein the brazing flux is a reactive flux and the coating of the brazing flux composition is free from metal and/or silicon particles. As previously pointed out, Morley only shows the presence of a (meth)acrylate and the presence of (meth)acrylic acid is not disclosed. It is known that if the carboxyl group-containing synthetic resin is mixed with the reactive flux of this

reference, such as a zinc-based flux, the viscosity of the brazing flux composition will increase due to the chemical reaction between the carboxyl group in the flux and the synthetic resin. For this reason, (meth)acrylic acid is not present in the synthetic resin of this reference. On the other hand, the present invention requires that the aluminum brazing composition contain a (meth)acrylic copolymer including at least one carboxyl group-containing monomer as well as a (meth)acrylic acid/(meth)acrylate copolymer emulsion to overcome the problem of the viscosity of the brazing composition increasing due to the chemical reaction between the carboxyl group in the synthetic resin and the flux. Therefore, there is no suggestion in this reference which would motivate one of ordinary skill in the art to substitute the reactive flux disclosed there with the flux shown in the primary Hasegawa et al reference and add the copolymer emulsion required in the present claims. As such, Morley et al adds nothing to Hasegawa et al.

Conn et al discloses a flux composition which contains a flux material consisting essentially of potassium tetrafluoroaluminate, a carrier system such as a glycerol-ethylene glycol system, a binder and a liquid medium such as water. In this reference, the flux is potassium tetrafluoroaluminate and xanthan is added as a binder to prevent the flux composition from separating from suspension.

In contrast to the Conn et al reference, the present invention uses a zinc-based flux which forms a zinc diffusion layer on the surface of the aluminum material to provide a sacrificial corrosion effect, and reduce and remove an oxide film formed on the surface of the aluminum material to promote the formation of a eutectic alloy of aluminum and a brazing filler metal. However, since the zinc flux of the present invention precipitates within a few hours after preparation of the flux material due to the specific gravity of the zinc flux in the brazing composition being extremely large, it necessitates the stirring of the brazing composition at the

time of the application and causes the brazing composition to solidify at the bottom of a container. The precipitation phenomena prevents uniform application of the brazing composition.

(Meth)acrylic acid/(meth)acrylate copolymer emulsion is used as a precipitation inhibitor in the present invention for the zinc-based flux in an amount of 0.03-1.50 wt.% based on 100 wt.% of the brazing composition and the numerical value of the weight average molecular weight of the copolymer in the emulsion used as a precipitation inhibitor is more than ten times greater than that of the copolymer of the organic binder to give the brazing composition a thixotropic index of 1.01-1.20. Even if the xanthan of Conn et al was used as a precipitation inhibitor in an amount of about 0.4-10 grams/liter of the brazing composition as discussed in Claim 6 of this reference, it would be difficult to remove the precipitation phenomena in the present invention. The use of xanthan as a precipitation inhibitor would result in non-uniform application of the brazing composition. Using an excess of xanthan would result in the formation of a carbide residue. When potassium tetrafluoroaluminate is used as the flux, xanthan can prevent the flux composition from separating from a suspension, even in the disclosed amount, because the specific gravity of the potassium tetrafluoroaluminate is not large. However, the present invention differs from Conn et al in that the flux and the binder are different. Therefore, one of ordinary skill in the art would not be lead to using a (meth)acrylic acid/(meth)acrylic copolymer emulsion as a precipitation inhibitor based on the disclosure of Conn et al.

The Harakawa et al reference discloses an aqueous metallic coating composition comprising a film-forming aqueous acrylic polymer, an alkyl (meth)acrylate, a phosphoric ester group-containing polymerizable unsaturated monomer represented by a specified formula, a carboxyl-containing polymerizable unsaturated monomer, a hydroxyl-containing polymerizable unsaturated monomer and another polymerizable unsaturated

monomer together with a metallic flake pigment. In the outstanding Office Action, the Examiner has stated that the composition disclosed in this reference is of the type that can be used for brazing. However, the composition of Harakawa et al cannot be applied to a brazing composition. The organic binder of the present invention is designed to fully volatilize during the brazing process. In contrast thereto, the composition of Harakawa et al is designed to use a colored base coat, as shown in Claims 5 and 6, and is suitable for forming a topcoat on automotive exterior panels (column 13, lines 44 and 45). The composition of Harakawa et al is not intended to volatilize but instead form a coating. Therefore, even if the composition of Harakawa et al was used in the brazing composition of the previously cited references, it would not fully volatilize during the brazing process. As such, the organic composition of the present invention and the references previously cited by the Examiner is quite different from the composition of Harakawa et al in both intent and effect.

The newly cited references do not present a showing of prima facie obviousness under 35 USC 103(a). Moreover, on pages 24-43 of the present specification, there are presented numerous Examples of the present invention and Comparative Examples which are closer to the present invention than the disclosures of the references cited by the Examiner. These Examples and Comparative Examples provide objective test data which clearly establish the criticality of the component composition of the aqueous aluminum brazing composition of the present invention. This objective data is clearly more than sufficient to overcome any proper showing of prima facie obviousness under 35 USC 103(a).

The Examiner is respectfully requested to reconsider the present application and to pass it to issue.

Respectfully submitted,


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